CHAPTER 4

HAZARDOUS MATERIALS

LEARNING OBJECTIVES

Upon completing this chapter, you should be able to do the following:

1. Identify the hazardous materials found in Fire Controlman workspaces and the safety precautions associated with each material.
2. Identify the storage requirements for hazardous materials.

INTRODUCTION

What are hazardous materials (HM)? A hazardous material is any material that, because of its quantity, concentration, or physical or chemical properties, may pose a substantial hazard to human health or the environment when used incorrectly, spilled accidentally, or released purposefully. Subcategories of HM include: combustible materials; toxic materials; corrosive materials (including acids and bases); and oxider, aerosol, or compressed gases. Cleaning solvents, paints, batteries, and floor wax are specific examples of hazardous materials.

Part of doing our job and maintaining our equipment and workspaces involves using hazardous materials. Whether we use hazardous materials daily or infrequently, we need to know how to identify them and understand their use, storage, and disposal procedures.

Many hazardous materials, if not used properly, can be hazardous to your health. For example, they can burn or irritate your skin, cause internal damage if you inhale them, or poison you if you ingest them. You must, therefore, be aware of and follow safe handling, storage, and disposal procedures for all hazardous materials that you may have to use or work around.

You can find additional safety information on hazardous materials in the following publications:

- *Navy Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat*, OPNAVINST 5100.19 (Series), Chapters B3, C23, and D15.
- *Navy Occupational Safety and Health (NAVOSH) Program Manual*, OPNAVINST 5100.23 (Series), Chapters 6, 7, 9, 11, and 20.
- *Natural and Environmental Resources Manual*, OPNAVINST 5090.1 (Series), Chapters 1, 3, 10, 12, 15, 19, 20, and 21; and Appendices A, C, G, H, I, K, and L.

This chapter discusses how to identify hazardous materials and the safety precautions related to these materials.

IDENTIFICATION OF HAZARDOUS MATERIALS

All hazardous material containers must be labeled. Manufacturers of hazardous materials must follow strict Occupational Safety and Health Administration (OSHA) regulations on labeling. As a minimum, each label must clearly identify (1) the name of the material, (2) the name and address of the manufacturer, and (3) the nature of the hazard, including the target organ(s) affected by the material.

Hazardous materials provided through the stock system, including open-purchase materials, must meet these requirements. You are not authorized to relabel properly labeled hazardous materials.

The Navy places great importance on handling hazardous materials properly. To help you understand that importance, the following section describes the Material Safety Data Sheet required by OSHA, the Hazardous Material User's Guide (HMUG), and the labeling procedures required by the Department of Defense (DOD), the Chief of Naval Operations (CNO), and the Navy.

MATERIAL SAFETY DATA SHEET

OSHA regulations require employers to provide employees with safety information on the hazardous

materials with which they work. This law also pertains to Federal civilian and military personnel. Manufacturers must provide hazardous material information for all hazardous materials they produce and must make a Material Safety Data Sheet (MSDS) available to the users of each hazardous material.

In the Navy, MSDSs are provided in a computer database on compact disk read-only memory (CD-ROM) entitled "Hazardous Material Control and Management (HMC&M) System." The CD-ROM contains the *Hazardous Material User's Guide (HMUG)*, *Ships' Hazardous Material List (SHML)*, *Shipboard Safety Equipment Shopping Guide*, and the *Hazardous Material Information System (HMIS)*, which provides over 70,000 MSDSs for materials used within the DOD.

The MSDS must be available to all users of hazardous materials and their supervisors; therefore, the CD-ROM containing the HMC&M database is provided on board every ship and shore station. The MSDS is used to train hazardous material users on the dangers and precautions of that material. Each MSDS contains the following information:

- General information, including an emergency phone number for the material's manufacturer.
- Ingredients and identity information.
- Physical and chemical characteristics.
- Fire and explosion hazard data.
- Health and hazard data, including first aid.
- Precautions for safe handling and use.
- Control measures, including protective equipment.
- Transportation data.
- Disposal data.
- Label data.

Your hazardous material control supervisor or hazardous material/hazardous waste coordinator can provide you with an MSDS upon request. Ashore, the MSDSs for each work center are located within the work area. Aboard ship, MSDSs for every item of HM aboard are available either through the HMIS or by hard copy for open purchased items. Supervisors must provide instruction in MSDS understanding and use, and personnel using HM must be trained on the dangers and precautions contained within the MSDS before they actually use those materials.

HAZARDOUS MATERIALS USER'S GUIDE (HMUG)

The *Hazardous Materials User's Guide (HMUG)* provides safety data for hazardous materials commonly used on ships. The HMUG supplements the information contained in the Material Safety Data Sheets (MSDSs). Always refer to the MSDS first. Then use the HMUG to clarify any MSDS information you do not understand.

The HMUG provides compatibility information, control measures, safety precautions, health hazards, spill control, and disposal guidelines for 22 hazardous material groups (for instance, adhesives, cleaners, degreasers, paints, solvents, etc.).

- The Compatibility Information section lists example material classes that are not compatible with the hazardous material group and the types of reactions that could occur if incompatible materials should mix.
- The Control Measures section identifies and prescribes personal protective equipment (PPE) for the chemical hazards in the group.
- The Safety Precautions section provides safety guidance for using and storing hazardous materials in the group.
- The Health Hazards section points out common signs and effects of overexposure to the hazardous material and provides "What to do" instructions for the hazardous material user.
- The Spill Control section provides information for responding to a spill.
- The Disposal Guidelines section provides acceptable methods for disposing of materials within the group.

The HMUG does not include items such as ammunition, explosives, propellants, medical/pharmaceutical supplies, and radioactive materials.

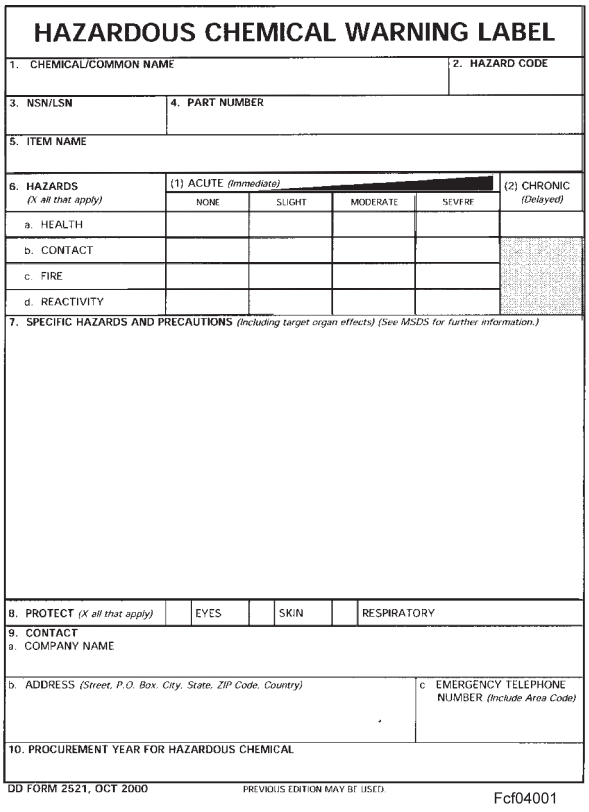
LABELING REQUIREMENTS

The Department of Defense (DOD) and the Navy both have standard label requirements for marking hazardous materials. Every Navy command must have a system to ensure that hazardous materials are

properly marked. Within that system, all HM must be labeled in one of the following ways:

- The original manufacturer's label or an exact copy of the manufacturer's label, or
- For National Stock Number material, the original stock system container label *or* an exact copy of the stock system label, or
- Standard DOD Hazardous Chemical Warning Label DD 2521(figure 4-1) or DD 2522(figure 4-2), or
- A label developed by the facility that contains the manufacturer's name, the product name, and either all hazard warnings provided by the original stock system/manufacturer's label, or a locally developed hazard warning based on the physical and health hazards listed on the stock system/manufacturer's label.

Some hazardous material containers may also display one of the Department of Transportation (DOT) shipping symbols shown in figure 4-3. These symbols depict the hazard category of the material and are used on outer packaging and on trucks and railway cars that transport those materials.



HAZARDOUS CHEMICAL WARNING LABEL

1. CHEMICAL/COMMON NAME | 2. HAZARD CODE

3. NSN/LSN | 4. PART NUMBER

5. ITEM NAME

6. HAZARDS (X all that apply)	(1) ACUTE (Immediate) NONE	SLIGHT	MODERATE	SEVERE	(2) CHRONIC (Delayed)
a. HEALTH					
b. CONTACT					
c. FIRE					
d. REACTIVITY					

7. SPECIFIC HAZARDS AND PRECAUTIONS (Including target organ effects) (See MSDS for further information.)

8. PROTECT (X all that apply) | EYES | SKIN | RESPIRATORY

9. CONTACT
a. COMPANY NAME

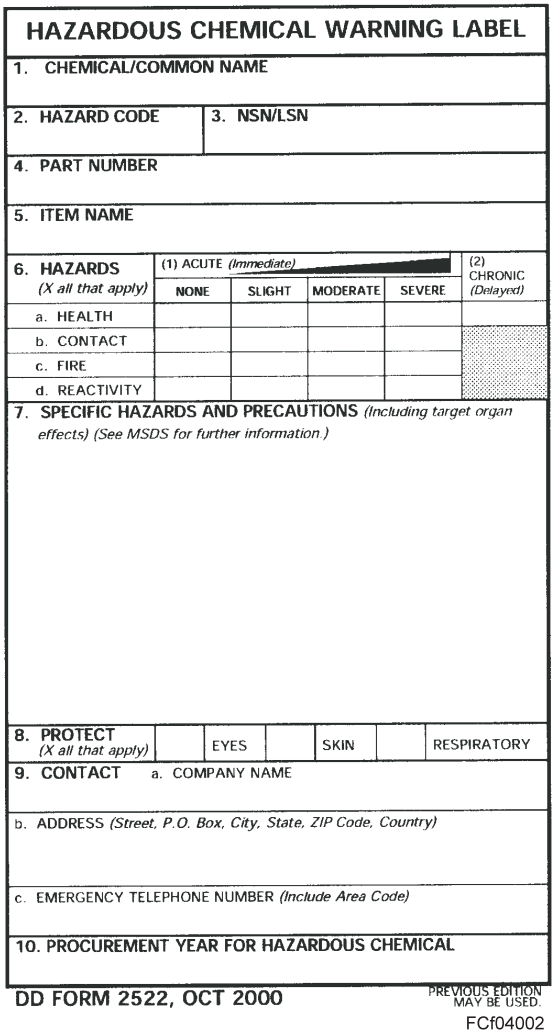
b. ADDRESS (Street, P.O. Box, City, State, ZIP Code, Country) | c. EMERGENCY TELEPHONE NUMBER (Include Area Code)

10. PROCUREMENT YEAR FOR HAZARDOUS CHEMICAL

DD FORM 2521, OCT 2000 PREVIOUS EDITION MAY BE USED.

Fcf04001

Figure 4-1.—Large Department of Defense Hazardous Chemical Warning Label (DD Form 2521).



HAZARDOUS CHEMICAL WARNING LABEL

1. CHEMICAL/COMMON NAME

2. HAZARD CODE | 3. NSN/LSN

4. PART NUMBER

5. ITEM NAME

6. HAZARDS (X all that apply)	(1) ACUTE (Immediate) NONE	SLIGHT	MODERATE	SEVERE	(2) CHRONIC (Delayed)
a. HEALTH					
b. CONTACT					
c. FIRE					
d. REACTIVITY					

7. SPECIFIC HAZARDS AND PRECAUTIONS (Including target organ effects) (See MSDS for further information.)

8. PROTECT (X all that apply) | EYES | SKIN | RESPIRATORY

9. CONTACT a. COMPANY NAME

b. ADDRESS (Street, P.O. Box, City, State, ZIP Code, Country)

c. EMERGENCY TELEPHONE NUMBER (Include Area Code)

10. PROCUREMENT YEAR FOR HAZARDOUS CHEMICAL

DD FORM 2522, OCT 2000 PREVIOUS EDITION MAY BE USED.

FCf04002

Figure 4-2.—Small Department of Defense Hazardous Chemical Warning Label (DD Form 2522).

Note: National Fire Protection Association (NFPA) labels do not comply with the requirements of the Occupational Safety and Health Administration (OSHA) Hazard Communication (HAZCOM) Standard. They may only be used to supplement a HAZCOM compliant label.

Q1. What is the minimum information that OSHA regulations require for labeling of hazardous materials?

Q2. What information can you find in the HMUG?

SAFETY PRECAUTIONS FOR HAZARDOUS MATERIALS

As we mentioned above, you must follow the prescribed safety precautions for the hazardous materials you use or handle in your workplace. These precautions are supported by requirements for

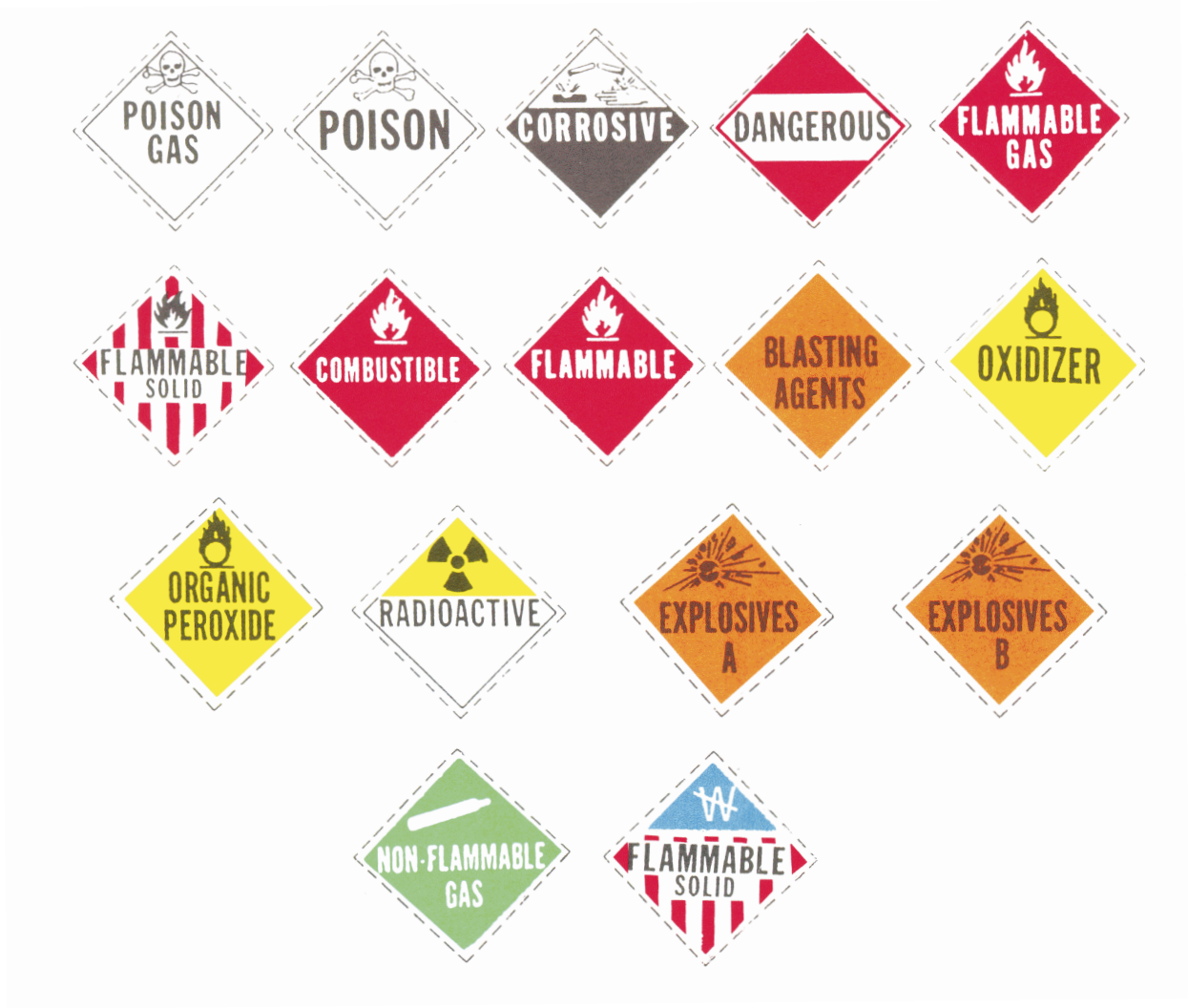


Figure 4-3.—Department of Transportation hazardous material shipping symbols.

personal protective equipment, spill response, and disposal of waste.

The following section briefly covers safety precautions for the materials commonly used or handled by Fire Controlmen: solvents, aerosol containers, polychlorinated biphenyls, batteries, and vacuum tubes.

SOLVENTS

Varnishes, lacquers, cleaning fluids, and some paints contain solvents that can ignite at relatively low temperatures. Obviously, such materials pose serious fire hazards. Some solvents emit toxic vapors; others can burn or irritate your skin and eyes.

Many solvents are used in the daily maintenance of electronic equipment. The safest solvents are those that dissolve in water (water-based). If water-based solvents are not effective, you may use trichloroethane or methyl alcohol, two of the most popular nonwater-based solvents. However, since trichloroethane and methyl alcohol are extremely flammable, use them only when you have adequate ventilation.

When you use hazardous paints or solvents, always follow these safety precautions:

- Wipe up all spills immediately.
- Place rags or other items you use to clean up spills in a separate, covered container.
- Use protective clothing, goggles, gloves, or other appropriate safeguards to prevent paints or solvents from getting on your skin or in your eyes.
- Have accessible fire-fighting equipment nearby.
- Have adequate ventilation.
- Dispose of paints and solvents properly when you no longer need them. If you are unsure of the

disposal procedures, check with your safety officer.

- Store flammable solvents only in approved flammable storage lockers. Be sure to store flammable and corrosive materials separately.
- NEVER use carbon tetrachloride. Carbon tetrachloride is a highly toxic compound and is banned from use. Use trichloroethane instead.
- NEVER smoke or use an open flame or allow anyone else to do so in areas where paint, varnishes, lacquers, or solvents are being used.
- NEVER breathe the vapors of any cleaning solvent for prolonged periods. If you don't have proper ventilation, use proper PPE.
- NEVER discard aerosol containers in wastebaskets that will be emptied into an incinerator.
- NEVER spray cleaning solvents onto electrical windings or insulation.
- NEVER apply cleaning solvents to heated equipment. Doing so could cause a fire.

AEROSOL CONTAINERS

Aerosol containers are everywhere. When used properly, aerosol containers dispense their chemicals quickly and effectively. But if you misuse them, they can hurt you and cause damage to your surroundings. To prevent this, you must be aware of the dangers associated with aerosol containers and how to protect yourself from those dangers.

Before you use any aerosol container, read its label. The label usually has instructions on how to use, store, and dispose of the container safely. Do **not** ignore these instructions. If you do, you may become ill from the toxic effects of the chemicals in the container. Even worse, you may be seriously injured if the container explodes.

Here are some basic rules to follow when using aerosol containers:

Ventilation: Ensure that you have plenty of ventilation when you use aerosols that contain dangerous or toxic gases. If you *must* use such aerosols when ventilation is not adequate, wear the appropriate PPE.

Heat Sources: Keep all aerosol containers away from open flames, sunlight, heaters, and other possible sources of heat. Do not smoke in areas where aerosols are being used.

Disposition: NEVER discard aerosol containers in wastebaskets that will be emptied into an incinerator, as they could explode. Dispose of the containers according to the MSDS's instructions. Some aerosol containers are considered hazardous waste.

Paint: NEVER spray paint or other protective coatings onto warm or energized equipment, as you may cause a fire.

Skin: NEVER spray paints or solvents onto your skin. Some liquids in aerosol containers may burn you; others may cause a skin rash.

Dents/Punctures: NEVER dent or puncture aerosol containers. Since they are pressurized, they may explode if they become dented or punctured.

Temperature: NEVER store aerosol containers in heated areas where temperatures can exceed the recommended storage temperature on their labels. Aboard ship, all aerosols are considered flammables and must be stored in a flammable liquid storage compartment or cabinet.

POLYCHLORINATED BIPHENYLS

Polychlorinated biphenyls (PCBs) are toxic chemicals of the chlorinated hydrocarbon group. They range in form and appearance from oily liquids, to crystalline solids, to hard transparent resins. These chemicals exhibit many favorable physical and chemical properties, including high heat capacity, chemical stability, noncorrosivity to metals, low flammability, low vapor pressure, and low electrical conductivity. Therefore, they are used extensively as insulators and coolants in electrical equipment.

PCBs in use aboard ship typically function as insulating fluids or coolants in electrical equipment. (The chemicals might occasionally be found in totally enclosed hydraulic and heat transfer systems.)

Remember, these chemicals are toxic. That means they can be harmful to your health (perhaps deadly.) Their adverse effects can result from either brief or repeated exposure. The effects from short-term contact with high concentrations of PCB vapors or liquids include eye, nose, and throat irritation; headaches; and the skin rash chloracne. Repeated exposure can result in severe skin irritation, respiratory irritation, digestive tract damage, and liver damage. Systemic intoxication

(an adverse effect to your entire bodily system) can result from severe overexposure. It is indicated by nausea, vomiting, weight loss, jaundice, and abdominal pain. It can be fatal.

To protect personnel, use the label shown in figure 4-4 to mark all equipment and cabinets containing in-service small and large PCB capacitors. You can find additional information on PCBs in the *Shipboard Management Guide for Polychlorinated Biphenyls (PCBs)*, NAVSEA S9593-A1-MAN-010. We highly recommended that you study this publication.

BATTERIES

A battery is a group of cells that provide direct-current (dc) electrical power. Batteries are used in automobiles, boats, aircraft, ships, submarines, lighting equipment, and portable and stationary electrical and electronic equipment. They can be used as main power sources or as secondary or backup power sources. Some batteries are rechargeable.

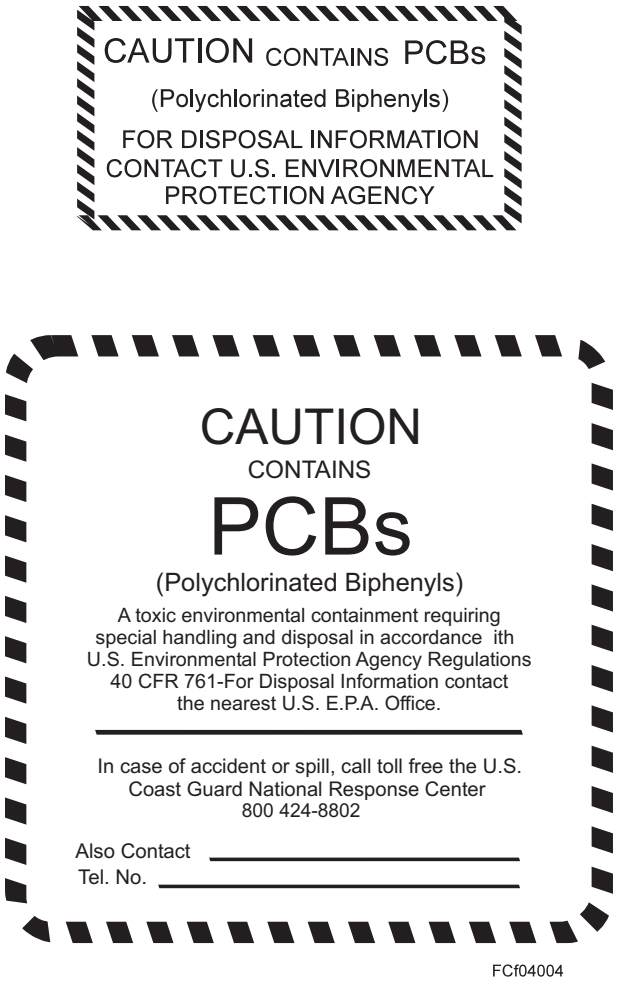


Figure 4-4.—EPA-require labels for PCB hazards.

Batteries can be dangerous. If used or handled improperly, they can explode, release toxic gases, or leak hazardous chemicals.

The following section will give you the safety precautions for some of the more common types, such as carbon-zinc dry cell batteries, manganese-dioxide alkaline-zinc cell batteries, lithium cell batteries, and nickel-cadmium cell batteries.

Carbon-Zinc Dry Cell Battery

The carbon-zinc dry cell battery is a very common battery in the Navy. It has a zinc outer container, a carbon center electrode, and a chemical paste for the electrolyte. It is usually sealed in a cardboard or plastic casing.

When you use, store, or dispose of carbon-zinc batteries, always observe the following safety precautions:

- NEVER store carbon-zinc batteries in electronic equipment for extended periods. The corrosive electrolyte could leak out of the battery and damage the equipment.
- NEVER throw carbon-zinc batteries into a fire or an incinerator. They could explode.
- NEVER throw carbon-zinc batteries overboard while at sea; they contain metal pollutants. Store them on board (in a plastic-lined metal container) until you can properly dispose of them ashore. See the *Environmental and Natural Resources Program Manual*, OPNAVINST 5090.1 (Series) Appendix L.

Manganese-Dioxide Alkaline-Zinc Cell Battery

Commonly called an *alkaline* battery, the manganese-dioxide alkaline-zinc cell battery is similar to the carbon-zinc battery. The only difference is the type of electrolyte used. These batteries are used in portable electronic equipment. The safety precautions for alkaline batteries are identical to those for carbon-zinc batteries.

Lithium Cell Battery

The lithium cell battery is a high-energy, long lasting battery with a longer shelf life than most other batteries. It is often used in electronic equipment, such as computers, communications and cryptographic equipment, torpedoes, and missiles. Unfortunately, lithium batteries can be very dangerous. They can

release toxic gases or explode. If you handle lithium batteries, observe the following safety precautions to prevent injuring yourself and damaging your equipment:

- Use only lithium batteries that are approved for use in your equipment.
- Store lithium batteries in cool, well-ventilated areas away from flammable items.
- Always observe polarity when you install lithium batteries.
- NEVER pierce, short-circuit, recharge, crush, cut, burn, drop, dismantle, modify, or otherwise carelessly handle lithium batteries.
- NEVER leave lithium batteries in equipment that will not be used for long periods of time.
- NEVER throw lithium batteries in daily trash. Dispose of them properly. See the *Environmental and Natural Resources Program Manual*, OPNAVINST 5090.1, for more disposal information on lithium batteries.

Nickel-Cadmium Cell Battery

Commonly known as a NICAD, the nickel-cadmium battery is used in most cordless, rechargeable equipment, such as flashlights, cordless drills, soldering irons, and portable stereos.

The following safety precautions for NICADs are relatively simple:

- Charge NICADs in series, never in parallel.
- Follow the manufacturer's instructions for charging NICADs.
- NEVER expose NICADs to temperatures over 113 degrees Fahrenheit (45 degrees Celsius).
- NEVER short-circuit NICADs.
- NEVER store NICADs and lead-acid batteries in the same container or in the same area.
- NEVER dispose of by throwing them overboard. Store exhausted cells temporarily in a plastic-lined steel container until you can dispose of them properly ashore. See the *Environmental and Natural Resources Program Manual*, OPNAVINST 5090.1 (Series) Appendix L.

VACUUM TUBES

There are two basic categories of vacuum tubes: (1) electron tubes, and (2) cathode-ray tubes. As for other hazardous materials, you must follow certain safety precautions when you work with or handle vacuum tubes.

Electron Tubes

Electron tubes are fairly rugged devices. Most of them can handle the shocks and knocks of everyday use. However, they are not indestructible. Most electron tubes contain a near vacuum enclosed by glass.

Any excessive stress, like dropping the tube, may cause the glass to shatter, causing an implosion (burst inward). An implosion is the opposite of an explosion. When the glass shatters, the outside air rushes into the tube to fill the vacuum. As the air rushes into the tube, it carries the glass fragments with it, right on through the center of the tube and out the other side. If you are in the path of these flying fragments, you may be injured seriously. So, handle all electron tubes with care.

Some electron tubes contain radioactive material to aid ionization. These must be handled with extra care. Unbroken, the radioactive tubes are as safe as other electron tubes because the radioactive material in the tube emits slow-moving particles that are contained within the tube's thick glass envelope. However, breaking the tube will expose the hazardous radioactive material.

To avoid injuring yourself or others, observe the following safety precautions when you handle either regular or radioactive tubes:

- Handle all electron tubes, whether radioactive or not, with extreme care.
- Immediately place any electron tube that you remove, whether radioactive or not, into a protective container, such as its shipping container.
- Inform your supervisor immediately if you break a radioactive electron tube.
- Seal off a radioactive-contaminated area immediately to avoid exposing other personnel to the radioactive material.
- Treat all bad or damaged radioactive electron tubes as radioactive waste and dispose of them accordingly.

- NEVER remove a radioactive tube from its shipping container until you are ready to install it.
- NEVER touch any radioactive fragments. If you do, wash yourself thoroughly with soap and water and get medical attention.

Cathode-Ray Tubes

Cathode-ray tubes (CRTs) are everywhere: in televisions, desktop computers, radars, and electronic warfare systems. As a Fire Controlman, you will probably maintain electronic systems that use CRTs. Therefore, you must know about their hazards, handling, and disposition.

CRT HAZARDS. Working with CRTs can be extremely hazardous. A CRT consists of a large glass envelope that maintains a high internal vacuum. It also has a toxic phosphor coating on its face. CRTs are under great pressure; for example, a 10-inch CRT is subject to nearly 2,000 pounds of force. Of that, 1,000 pounds is impressed on the face of the tube alone. Therefore, breaking the glass envelope will cause a violent implosion. During the implosion, all the glass fragments, metal parts, and toxic phosphor will be expelled violently. Because a CRT carries a very high voltage and emits x-rays, it can also be hazardous when it's energized.

CRT HANDLING. To protect yourself from serious injury when you handle CRTs, follow these precautions:

- Follow the manufacturer's handling instructions.
- Keep a new CRT in its shipping carton until you are ready to use it.
- Place a defective CRT in its shipping carton immediately after you remove it from the equipment.
- Wear gloves and goggles.
- NEVER remove a CRT until you have discharged its high-voltage anode.
- NEVER strike or scratch the surface of a CRT's glass envelope.
- NEVER stand in front of a CRT when you install it. If the CRT should implode, the electron gun in its neck could be propelled at a very high velocity through the face of the tube and into your body.
- NEVER carry a CRT by its neck.
- NEVER touch a CRT's phosphor coating; it is extremely toxic. If you break a CRT, clean up the glass fragments very carefully. If you touch the phosphor, seek medical attention *immediately*.

CRT DISPOSAL. CRTs are disposed of either by shipping them back to the manufacturer or by discarding them locally. If you ship a CRT back to the manufacturer, put it in the shipping container intact. If you dispose of a CRT locally, follow the procedure prescribed by your safety officer.

Q3. What are PCBs normally used for on board a ship?

Q4. What are two hazards associated with an energized CRT?

GENERAL STOWAGE REQUIREMENTS OF HAZARDOUS MATERIALS

Proper stowage of hazardous materials is essential to ship and personnel safety. Supply department and individual work-center personnel are responsible for the proper stowage of hazardous materials in areas under their control. For answers to your questions concerning hazardous material stowage, consult your supervisor, supply officer, or hazardous material/ hazardous waste coordinator.

Hazardous materials aboard ship are typically packaged in cases or allotments of individual containers. Do not store hazardous materials in heat-producing areas or near heat-producing items. Shield hazardous materials stored on a weather deck or in exposed areas from direct sunlight.

Temporary storage of hazardous material in workspaces is limited to the amount necessary for the operation and maintenance of assigned equipment. If a HAZMINCEN is in operation, no more than a 7-day supply of common-use HM may be kept in workcenter spaces.

Study the *Naval Ships' Technical Manual*, Chapter 670, *Stowage, Handling, and Disposal of General Use Consumables*, NAVSEA S9086-WK-STM-010, and become familiar with its contents. You can find additional information in the *NAVOSH Program*

Manual for Forces Afloat, OPNAVINST 5100.19 (Series), *NAVOSH Program Manual*, OPNAVINST 5100.23 (Series), and the *Environmental and Natural Resources Program Manual*, OPNAVINST 5090.1 (Series).

SUMMARY

In your normal working environment you will be surrounded by hazardous materials. Whether that means greases, oils, paints, primers, or cleaners and detergents, you will be in daily contact with materials that are hazardous to you. Material Safety Data Sheets (MSDSs) give safety information for materials you use in doing preventive maintenance. The Hazardous Material User's Guide (HMUG) gives general guidelines for all types of hazardous materials. Many of these materials have long-lasting consequences that can effect your health even after many years. The Navy is making great strides in using less toxic materials for doing routine maintenance, but there are some materials in use that will always be hazardous to humans. Because of this, you should learn all you can about all of the materials you use. Educate yourself and your fellow FCs concerning the specific hazardous materials you use and know the safety precautions, first-aid procedures, and stowage requirements that are associated with each type of material.

ANSWERS TO CHAPTER QUESTIONS

A1. (1) the name of the material, (2) the name and address of the manufacturer, and (3) the nature of the hazard, including the target organ affected by the material.

A2. Compatibility information, control measures, safety precautions, health hazards, spill control, and disposal guidelines for 22 hazardous material groups.

A3. Insulators and coolants in electrical equipment.

A4. A very high voltage and x-ray emissions.